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(54) Tamper indicating closure

(57) A tamper indicating closure includes an outer cap (20) carrying an inner liner (30) which relies on relative movement of the outer cap and the inner liner during opening movement to indicate tampering (e.g. by "opened" on liner appearing in aperture 60 in the cap) with the container after it has been sealed for the first time, the relative movement being ensured by a friction surface (34) which coacts with the inner surface (35) of an opening in the container to resist rotation of the liner and maintain it in a sealed condition while the outer cap is being rotated in an opening direction. Once opened, the outer cap (20) and the inner liner (30) are maintained in a position for movement as a unit in both the opening and closing direction of the closure. On initial application to the container drive elements (50) in the cap engage surfaces (46) on the liner and "sealed" appears in aperture (60) and on first opening of the container the drive elements pass over ramps 66 into the spaces between surfaces (48) and (68) and "opened" appears in the aperture (60) and the drive elements are thereafter retained in those spaces.

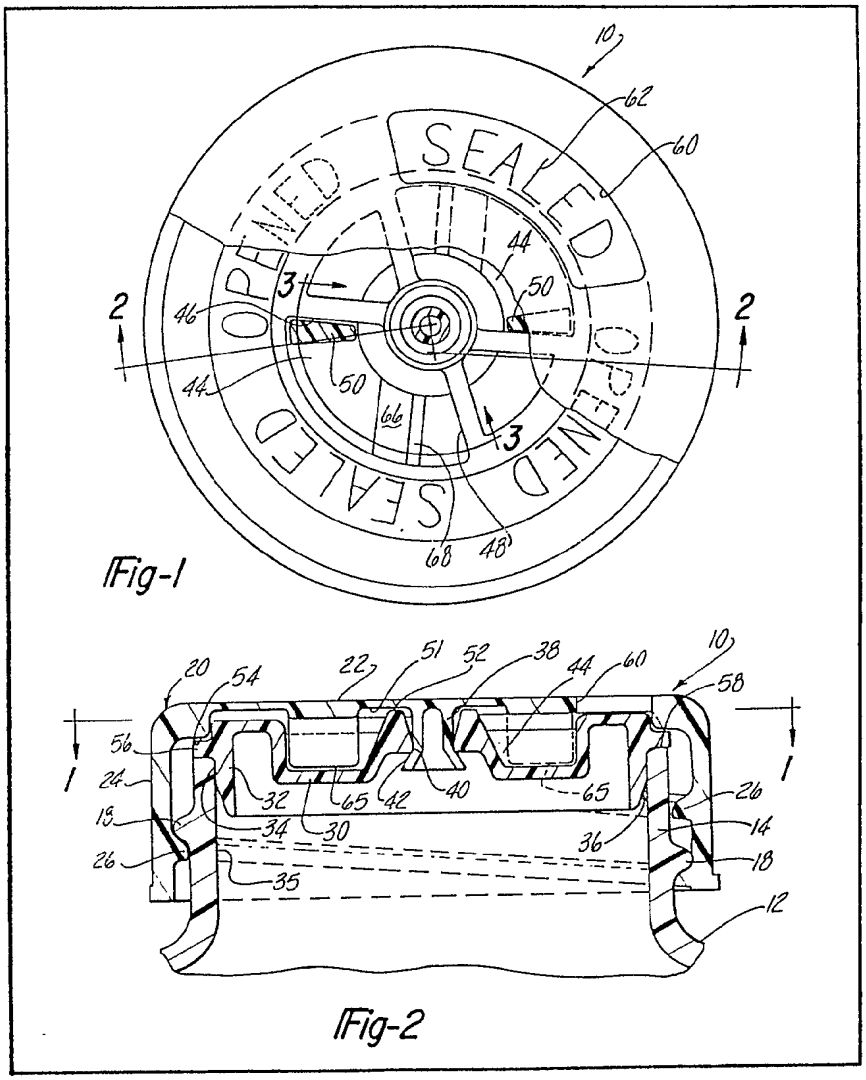

Fig-1

Fig-2

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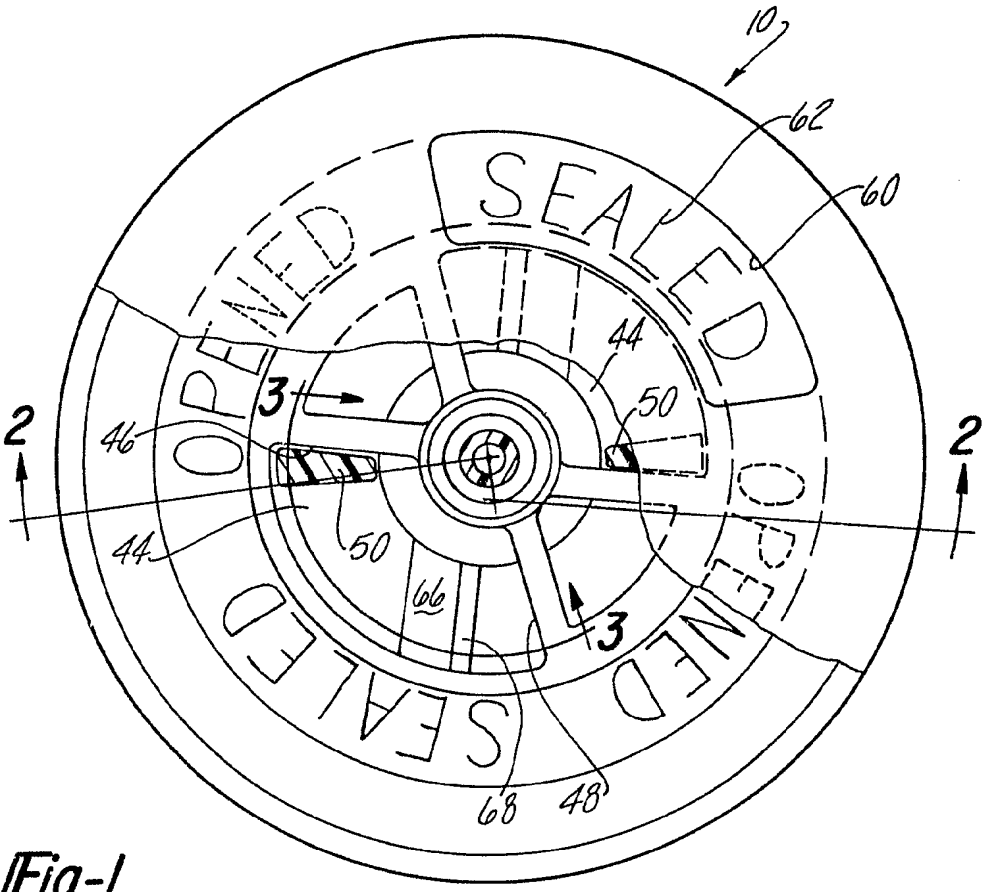
10
62
60
SEALED
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50
46
3
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2
44
50
66
3
68
48

Fig-1

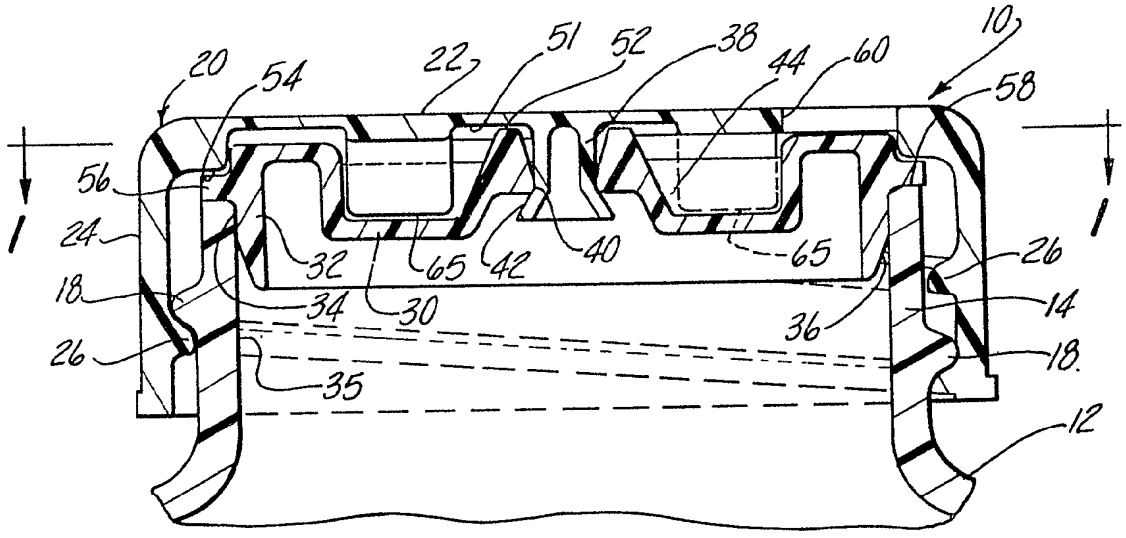
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Fig-2

Fig-3

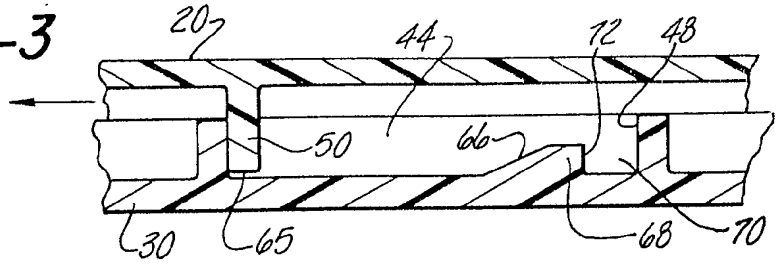


Fig-4

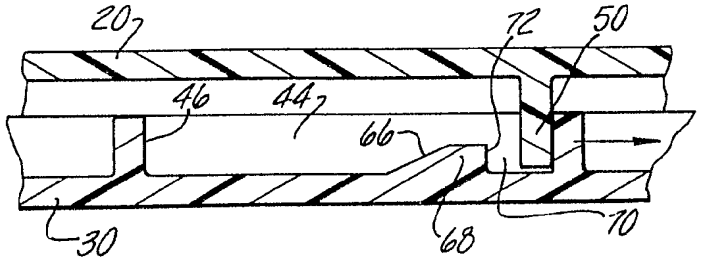


Fig-5

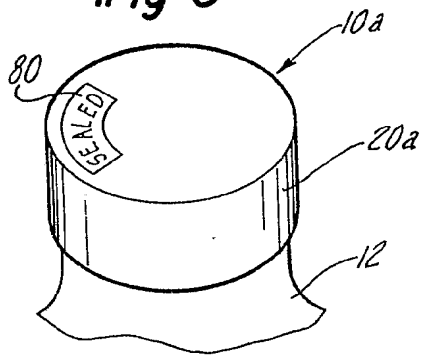
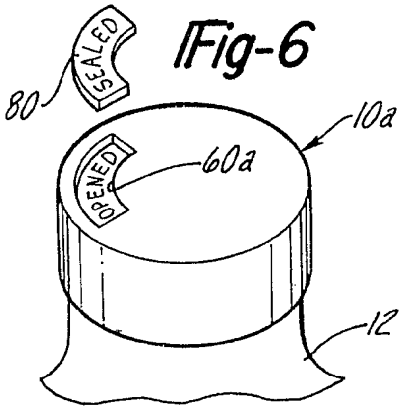


Fig-6



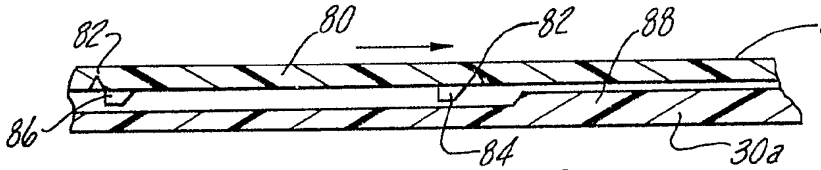


Fig-7

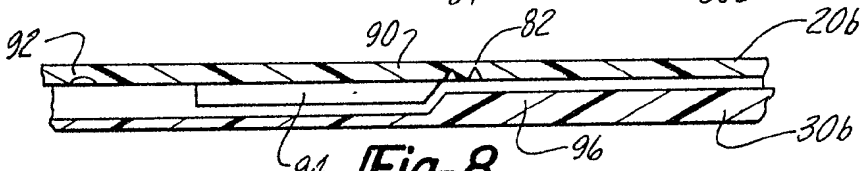


Fig-8

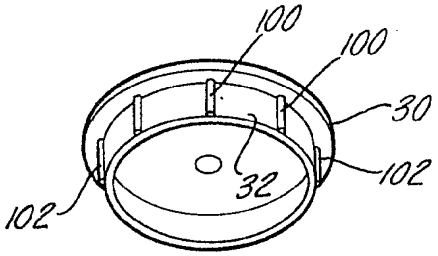


Fig-9

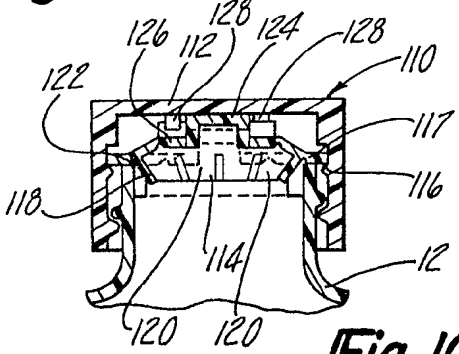


Fig-10

SPECIFICATION

Tamper indicating closure

This invention relates to closures for containers and more particularly to closures of the type which indicate tampering.

There are a large variety of closures for containers which attempt to give evidence that the container has been opened or at least been placed in a condition for opening once it has been filled. The purpose of such closures is to ensure that consumers can be confident that a closure has remained in a closed position once it has been filled and not opened prior to its purchase.

It is a general object of this invention to provide a tamper indicating closure which does not require a special container and therefore can be used with a wide variety of containers of standard configuration.

Still another object of the invention is to provide a tamper indicating closure which can give a worded message indicating that the closure has once been opened or placed in condition for opening.

Yet another object of the invention is to provide a tamper indicating closure of simple two-part construction which provides for easy manufacture and assembly.

The objects of the invention are accomplished by a tamper indicating closure having a cap portion for threaded engagement with the threaded neck of a container and having a liner capable of sealing the closure. The closure provides for complementary drive and driven surfaces which permit the cap to be placed on the container for the first time after it is filled to move the liner into a sealed condition. Other complementary drive and driven surfaces are provided which come into engagement with each other after the cap has been rotated relative to the stationary liner to provide a message or a condition of the closure giving evidence that the closure has either been removed from the container or placed in a condition relative to the container by which it can be moved. These complementary drive and driven surfaces enable the cap and liner to be moved as a unit to a fully opened position. Additional cooperating drive and driven surfaces are provided which ensure that the closure can be replaced on the container once it has been removed while at the same time the condition of the closure remains established to give evidence of the opened condition.

The currently preferred embodiments are illustrated in the accompanying drawings in which:

Figure 1 is a top view of the closure embodying the invention with parts broken away and removed;

Figure 2 is a cross sectional view taken on line 2—2 in Figure 1;

Figure 3 is a cross sectional view taken on the arcuate line 3—3 in Figure 1;

Figure 4 is a cross sectional view similar to Figure 3 but showing another condition of operation;

Figure 5 is a perspective view of another embodiment of the invention showing the closure in its initially closed position relative to a container, only a portion of which is shown;

Figure 6 is a view similar to Figure 5 showing the condition of the closure once it has been placed in condition for opening;

Figure 7 is a cross sectional view taken generally on the arcuate section line 7—7 in Figure 5;

Figure 8 is a cross sectional view similar to Figure 7 showing a modification of the embodiment seen in Figure 7;

Figure 9 shows a modification of a portion of the closure in the prior embodiments of the invention; and

Figure 10 shows still another embodiment of the invention in a cross sectional view similar to Figure 2.

A tamper indicating closure embodying the invention is designated generally at 10 and is adapted for use with containers 12 having a neck 14 forming an opening 16 through which contents can be introduced and dispensed from the container. The exterior of the neck 14 has external threads 18 adapted to receive complementary threads on the closure 10.

The closure 10 includes a cup-shaped cap 20 with a generally flat top 22 and a depending annular skirt 24. The skirt 24 is provided with internal threads 26 complementary to the threads 18 on the exterior of the neck of the container 12. The closure 10 also includes a liner member 30 which is disposed within the cup-shaped cap 20. The liner member 30 is provided with a depending annular flange 32 having an outer, annular cylindrical friction ring or surface 34 which is seated in engagement with the inner wall 35 of the opening 16 in the neck 14 of the container 12. A cam surface 36 is provided below the friction surface 34 to act as a guide upon introduction of the liner member 30 into the opening 16 in the neck 14 of the container 12.

The liner member 30 is supported relative to cap 20 by a central depending hollow post 38 which is formed integrally with the cap 20 and which projects through an opening 40 axially of the member 30. The end of post 38 projecting through the opening 40 is deformed to form a rivet-like head 42 by which the liner member 30 is maintained in assembled relationship with the cap 20. This supporting arrangement permits rotational movement of the liner member 30 relative to the cap 20 and at the same time permits a small amount of relative axial movement. Both the cap 20 and the liner 30 can be moulded of similar or of different plastic materials which permit some deflection relative to each other. For example, the cap can be made of polypropylene to enhance thread engagement whereas the liner may be made of high density polyethylene.

The liner member 50 has a pair of symmetrical

recesses 44 disposed arcuately of the axis of the liner member 30. Opposite ends of the recesses 44 have walls 46 and 48 which form driven surfaces that are engageable by a drive lug 50, one of which is disposed in each of the recesses 44 and are formed integrally with the cup-shaped cap member 20.

As seen in Figures 1 and 2 the lugs 50 are in engagement with the walls 46 so that clockwise rotation of the cap 20 is effective to move the cap 20 and liner 30 as a unit to bring the complementary threads 18 and 26 into engagement with each other to move the closure 10 in a closing direction. Such movement causes the closure 10 to move axially relative to the container so that the cam surfaces 36 enter the opening 16 in the neck 14 and subsequent clockwise threaded rotation causes the cylindrical friction surface 34 to be moved axially into seated engagement with the internal surface 35 of the opening 16. Such axial movement is transmitted from the cap 20 to the liner member 30 by means of engaging surfaces 51 around the base of the post 38 on the cap 20 and an annular surface 52 surrounding the opening 40. In addition, an annular force transmitting surface 54 is formed adjacent the interior circumferential area of the cap 20 as seen in Figure 2 for engagement with a force transmitting flange 56. The surfaces 54 and flange 56 are complementary to each other and as the cap 20 is threaded onto the neck of the container 12 the liner member 30 is forced axially and downwards to bring the cylindrical friction surface 34 into engagement with the interior surface of the opening in the neck. When the closure 10 is in the fully closed position, the friction surface 34 is engaged with the interior of the opening in the neck over an axial range which ensures continued contact before the closure is in its fully closed position. In the fully closed position, the bottom of the flange 56 forms a seal which is pressed into engagement with the top lip 58 of the neck 14. In addition to providing an axial cylindrical extent of friction surface, the exterior diameter of the surface 34 has a slightly large outer diameter than the diameter of the opening 16 in the neck 14 and with a smooth exterior can act as a seal. Preferably the liner member is made of a plastics material which has some elastomeric qualities permitting deformation and movement to a seated position.

In the initially closed position of the closure 10 on the container 12, the drive lugs 50 will be in engagement with the walls 46 of the recesses 44, in which case a window 60 formed in the top 22 of the cap 20 is in alignment with a message of indicium indicated at 62. In the illustrated embodiment of the invention the indicium 62 is in the form of the word "sealed". This is the message that will appear after the container 12 has been filled and closed with a closure 10 either manually or automatically for the first time.

To open the closure 10 and remove it from the container 12, the cap 20 is grasped in conventional fashion and is rotated in a counterclockwise direction as viewed in Figure 1. During such rotational movement of cap 20 in a counterclockwise direction, the liner member 30 remains stationary relative to the neck 14 because of the interference fit and large surface engagement of the friction surface 34 with the interior of the opening 16. This causes the lugs 50 to move out of engagement with the walls 46 toward the walls 48.

When the drive lugs 50 eventually come into engagement with the walls 48, when the cap 20 is rotated in a counterclockwise direction, the window 60 will have moved out of alignment with the indicium 62 and into alignment with the second message of indicium indicated at 64. In this instance the message is that the container has been opened.

Prior to the time that the lugs 50 come into engagement with the walls 48 upon clockwise movement of cap 20 in an opening direction, the lugs 50 must move through an arc of 30° or more, at which time the lower ends 65 of the lugs 50 simultaneously engage cam surfaces 66 formed on ramp elements 68 formed integrally with the seal member 30 at the bottom of each of the recesses 44.

The relatively movable cap causes the lug ends 64 to engage the cam surfaces 66 so that the cap 20 is deflected axially relative to the liner 30 until the lugs 50 pass to the other side of the ramp elements 68 at which point the lugs will snap into cavities 70 formed within the recesses 44 between the ramp element 68 and the wall surface 48. When the lug 50 has reached this position, the window 60 will be in alignment with the indicium 64 indicating that the container has been placed in the condition by which it can be opened. Subsequent counterclockwise rotation of the cap 20 brings the lugs 50 into engagement with the walls 48 so that additional rotation moves the cap 20 and liner 30 as a unit so that the closure 10 moves axially and the cylindrical friction surface 34 moves out of engagement with the interior of the neck 14 so that the closure 10 can be completely removed from the container.

During initial movement of the lug 50 from the sealed position of the closure 10 until the lug approaches the cam surface 66 the cap 20 will have been moved through approximately 30° of arc, which results in a corresponding axial movement of the cap 20. During such time the liner 30 remains non-rotatably fixed relative to the opening in the neck so that the container remains sealed. Such movement of the cap causes the force transmitting surface 54 and flange 56 to move out of engagement with each other and separate so that the only force applied by the cap 20 to the seal 30 is by way of the lug ends 65 on the cam surface 66. This force is a minimum and substantially less than the friction generated between the cylindrical friction surface 34 and the internal surface of the opening in the neck 14. In this manner the frictional forces between the cap and seal are minimized and kept less than the friction of the surface 34.

After the closure 10 has once been removed from the container 12 the window 60 will be in alignment with the indicium 62, indicating that the closure has been opened. Upon replacement of the closure 10 relative to the container 12, the cap 20 is rotated in a clockwise direction. This brings the opposite surfaces of the lugs 50 into engagement with a stop wall or driven surface 72 formed opposite to the cam surface 66 on the ramp element 68. In this position the window 60 remains in alignment with the indicium 64 showing that the closure 10 has been opened and at the same time affords a means by which the driving lug 50 transmits counter-clockwise motion to the seal so that the cap 20 and liner 30 are moved axially as a unit to bring the cylindrical friction surface 34 into engagement with the interior of the neck opening 16.

Referring now to Figures 3 and 4, it will be noted that the depth of the recesses 44 formed by the walls 46 and 48 is greater than the height of the ramp element 68. This ensures that lugs 50 are not deflected upwards a distance greater than the height of the wall surfaces 46 and 48, to ensure that the lugs will be precluded from passing the walls 46 and 48 in both the closing and opening directions of the closure 10. Also the height of the ramp element 68 is selected to be of an axial dimension greater than any axial movement that may be permitted between the cap 20 and seal 30 by the post 38 in the opening 40. This ensures that as the lug 50 passes over the ramp element 68, the cap 20 and liner 30 must deflect relative to each other and the lower end of the lug 65 is returned axially into the cavity 70. This ensures engagement of the lugs 50 with the stop surfaces 72 when the cap is moved in a closing direction for the purpose of returning the closure 10 to its sealing position on the container 12.

With the internal diameter of the opening 16 in the neck 14 of the container 12 known, it is possible to select easily an interfacing dimension for the outer cylindrical sealing surface 34 which will ensure interference and friction so that there is resistance to rotation of the liner 30 relative to the container 12 during rotation of the cap 20 from its closed to its open position.

It will be noted that the recesses 44, walls 46, 48 and lugs 50 and cavity 70 are arranged in pairs diametrically opposite each other. It will be understood of course that an even or odd number of such elements could be disposed uniformly and circumferentially of the cap 20 and liner 30. In the embodiment described, in which pairs are used, the liner 30 is provided with two sets of indicia 62 and 64 also arranged diametrically opposite each other. This makes it possible to assemble the cap 20 and liner 30 so that a selected one of the lugs 50 can be disposed in either of the cavities 44. Also, since there is a substantial arc between the walls 46 and the ramp elements 68 the assembly procedure does not require precise alignment of the cap 20 and liner 30, thereby facilitating simpler assembly equipment and techniques.

Referring now to Figure 5, 6 and 7 another embodiment of the invention is illustrated which in all respects can be the same as the embodiment of the invention disclosed in Figures 1 to 4 except that the cap 20 is provided with a window 60*a*, which in the closed position of the closure 10*a* on the container 12 is provided with a cover element 80. The cover element 80 defines an arcuate portion secured to the remainder of the cap 20*a* by lines of weakening or frangible areas indicated at 82 in Figure 7. The underside of the cover element 80 is provided with cam elements 84 and 86 which are adapted to engage a platform 88 formed on the top of a liner member 30*a*. The top of the cover element 80 can be provided with a message such as the word "sealed" and the top of the platform 88 can be provided with a message such as the word "opened".

The operation of the embodiment in Figures 5 to 7 is the same as the prior embodiment in that during opening movement of the closure 10*a* the liner member 30*a* remains stationary relative to the neck 14 of the container 12 but upon engagement of the cam 84 with the platform 88 the cover element 80 will be deflected and the adjacent frangible portions will fracture. Similarly, when the cam element 86 engages the platform 88 the adjoining frangible portions 82 will break away so that the cover element 80 becomes separated from the remainder of the cap 20*a*. This leaves an open window 60*a* which exposes the message "opened" on the platform 88. In this manner, once the closure 10*a* has been put in condition for opening, the message on the platform 88 will remain within the window 60*a* because the drive lugs 50 will be in the cavity 70 as illustrated in Figure 4 so that during all subsequent opening and closing movement the platform will be visible through the window 60*a*.

A further modification of the embodiment of Figures 5 to 7 is illustrated in Figure 8, in which a cover portion 90 is separated on three sides by lines of weakening and frangible portions 82. However, at least one end of the cover portion 90 remains attached to the remainder of the cap member 20 at a hinge point 92. In this modification of the invention a cam portion 94 on the underside of the cover element 90 comes into engagement with the platform 96 upon rotation of the cap 20*b* to raise the cover element 90 and hinge it about the hinge 92. In this version, opening movement is made apparent by the displacement of the cover portion 90 from other than a flat or flush condition with the remainder of the top of the cap. The cap 20*b* is held against rotation relative to the liner 30*b* by the positioning of the drive lugs 50 in cavity 70 so that the cap 20*b* and liner 30*b* rotate as a unit and the cam 94 remains in seated position on the platform 96 to keep the cover portion 90 displaced relative to the top of the cap to give evidence of tampering.

In the embodiments of Figures 5 to 8 opening movement is achieved while the liner 30*a* or 30*b*

remains stationary relative to the neck 14 of the container due to the friction ring or surface 34 until such time as the drive element 50 engages the driven wall 46 on the liner 30*a* or 30*b*.

Referring now to Figure 9, in some applications of the invention it may be necessary to vary the friction afforded by the friction surface or ring 34. In Figure 9 this is accomplished by a plurality of ribs 100 formed on the exterior surface of flange 32 to form a friction engaging surface 102. In this instance the number, spacing and degree of interference with the inside diameter of the neck 14 all may be varied to control accurately the amount of friction afforded by engagement of the ribs 100 with the interior of the neck 14.

Referring now to Figure 10, still another embodiment of the invention is shown in which a closure 110 is adapted for use on a container 12 identical with those used with the other embodiments of the invention. The closure 110 includes a cup-shaped cap 112 with threaded engagement with the threads on the neck 14 of the container 12. Disposed within the cap 112 is a liner member 114 which is held against separation from the cap 112 by a retaining flange 116 formed on the inside of the cap 112 and engageable with the underside of the annular flange 117 at the outer periphery of the liner member 114. The liner member 114 includes an annular friction flange 118 adapted to fit within the opening 16 in the neck 14. The friction flange 118 can be formed in segments 120 which are hinged at 122 relative to the outer flange 117. A central portion of the liner member 114 is provided with a platform 124 and is adapted to engage the underside of the cap 112. When the cap 112 is placed on a container, the threads engage and the cap 112 forces the platform 124 axially to deflect the segments 120 about their hinges 122 to bring them into engagement with the inside wall of the opening 16 to provide the friction necessary to resist rotation of the liner member 114 during opening movement of the closure 110. An annular area 126 adjacent to the platform 124 can be provided with the driven surfaces similar to the surfaces 46, 48 and 72, and the cap 112 has drive lugs 128. Also the cap 112 can be provided with a window and tamper indicating indicium or mechanism of the prior embodiments.

Several embodiments of a tamper indicating closure have been provided, in which tampering, that is, placing the closure in a condition by which it can be opened, is made evident either by way of a message or by the appearance of the closure. In some embodiments of the invention, a printed message appears at the surface of the closure indicating that the closure has been sealed so that subsequently when a cap is rotated in an opening direction the message is changed to one indicating that the closure has been opened or put in a condition by which it can be opened. Thereafter, the closure can be replaced and removed from the container when desired but the message or closure configuration will always indicate that the cap has once been opened. The change in messages is accomplished by a relatively movable cap and seal member in which the liner is maintained in a fixed position relative to the container by means of an interfering frictional fit on the liner and the rotatable cap. During the relative rotation, the messages or condition of the cap are changed and the cap is moved a small distance axially out of frictional engagement with the liner member to minimise frictional forces that might tend to move the liner until the cap comes into its final position showing that the closure has been opened. In all of the embodiments of the invention, tampering is indicated by a friction developing arrangement which ensures that the liner member remains stationary during relative rotation of an outer cap from its original closing position to an opening position. Once the cap has been moved to the opening position it remains in that position for all subsequent closing and opening movements of the closure and container.

Claims

1. A tamper indicating closure for containers having threaded necks forming an opening, comprising: a cup shaped cap member having internal threads to engage with threads on the neck of the container, a liner member supported by the cap member for rotation relative thereto, the liner member having an annular flange with a radially outwardly facing cylindrical friction surface for engagement with a complementary surface on the inner wall of the opening in the neck, the liner member forming adjoining first and second sectors, a window in the cap member alignable with said first sector and indicating an initially closed condition or with said second sector and indicating that the closure has been opened, cooperating drive means including a drive lug on one of the said members engageable with driven surfaces on the other of the said members, the driven surfaces including a first surface engaged by the lug when the window is in alignment with said first sector upon initial rotational movement of the cap and seal as a unit in a closing direction in which the seal member is moved axially in a seated position relative to the neck of the container, a second stop surface engageable by the lug following movement of the cap member in an opening direction relative to the liner member during which the friction surface remains seated and the window moves in alignment with said second sector after which the cap and liner members are movable as a unit to remove the friction surface from its seated position, a third driven surface between the first and second surfaces, the second and third surfaces being engageable by the lug when the window is aligned with said second sector for rotation of the cap and liner member as a unit for all subsequent movements of the closure in a closing or opening direction, a cam surface associated with said third surface to deflect the lug axially to pass to a position between the second and third surfaces while the friction surface remains seated, the resistance to axial

deflection of the lug being less than the resistance to rotation and axial movement of the friction surface from the seated position.

2. A tamper indicating closure according to claim 1 in which the cylindrical friction surface has an outside diameter greater than the inside diameter of the opening in the neck of the container to provide interference between the friction surface and the container.

3. A tamper indicating closure according to claim 1 or claim 2 in which an arcuate recess is formed in one of said members and forms the said first and second driven surfaces at opposite ends of the recess.

4. A tamper indicating closure according to claim 3 in which the cam surface is formed in the bottom of the recess.

5. A tamper indicating closure according to claim 4 in which the cam surface has an axial height less than the axial length of the cylindrical seal.

6. A tamper indicating closure according to any one of claims 1 to 5 and further comprising annular complementary load transmitting seats formed on the cap and the liner members to move the friction surface axially into a seated position upon closing movement of the cap member.

7. A tamper indicating closure according to claim 6 in which the third driven surface is positioned closer to the second driven surface than the first driven surface to permit rotational movement of the cap member relative to the liner member between the first and third surfaces to disengage the complementary load transmitting seats from each other to maintain low resistance to movement of the cap relative to the seal member in an opening direction.

8. A tamper indicating closure according to any one of claims 1 to 7 in which the adjoining first and second sectors form a first set of sectors, a second set of sectors formed by additional first and second sectors, the cap and liner members being assembled so that the window is alignable with one of the sets of sectors.

9. A tamper indicating closure according to any one of claims 1 to 8 in which the first and second sectors occupy no more than an arc of 180°.

10. A tamper indicating closure according to any one of claims 1 to 9 in which the drive lug has an arcuate dimension substantially less than the arcuate spacing of the second and third driven surfaces.

11. A tamper indicating closure according to any one of claims 1 to 10 in which the cylindrical sealing surface remains seated through an axial range greater than the axial deflection of the lug by the cam surface.

12. A tamper indicating closure according to any one of claims 1 to 11 in which the annular flange is provided with a plurality of uniformly spaced axially extending ribs for engagement with a complementary surface on the inner wall of the opening in said neck.

13. A tamper indicating closure according to any one of claims 1 to 12 in which the liner member is deflectable to press the friction surface into engagement with the complementary surface of the inner wall of the opening in the neck.

14. a tamper indicating closure according to claim 13 in which the friction surface is formed by a plurality of segments hingedly supported relative to the remainder of the liner member for deflection upon axial movement of the cap member on the container in a closing direction.

15. A tamper indicating closure according to any one of claims 1 to 14 in which the window in the cap member is closed by a cover member joined to the remainder of the cap member by frangible portions, this cover member being formed with cam portions that cooperate with complementary cam portions on the liner upon movement of the cap in an opening direction to fracture the frangible portions.

16. A tamper indicating closure according to claim 15 in which the cover member is completely separable from the window.

17. A tamper indicating closure according to claim 15 in which the cover member is hinged relative to the window and wherein fracturing of the frangible elements moves the cover member to a displaced position relative to the cap member to signify opening movement.

18. A tamper indicating closure for a container having a threaded neck forming an opening comprising: a cup shaped cap having internal threads to engage with threads on the neck, a liner member supported by the cap for relative rotation, the liner member having an annular flange with a radially outwardly facing friction surface for engagement with a complementary surface on the inner surface of the opening in the neck, the friction surface on the liner member having an outer diameter greater than the internal diameter of the opening in the neck for exerting a radial force permitting axial movement of the liner member relative to the neck through another limited axial range while maintaining the frictional engagement, the liner member forming adjoining first and second sectors each with separate indicia, a window in the cap alignable with said first sector to indicate an initially closed condition or with said second sector to indicate that the closure has been opened, an arcuate recess in the tip of the liner member, a lug formed on the cap and disposed in the recess and engageable with one end of the recess when the window is aligned with said first sector to rotate the cap and the seal as a unit in a closing direction, the lug being engageable with the other end of the recess when the window is aligned with said second sector for rotation of the cap and seal as a unit in an opening direction, a ramp element disposed in the recess and being engageable with the lug to deflect the cap axially and permit rotational movement of the cap relative to the liner member from the closing position to the opening position, the ramp element forming a stop engageable with the lug to prevent relative movement of the cap and seal and maintain the window in alignment with said second sector during all subsequent

closing movement of the closure, the ramp element having an axial height greater than the said limited axial range and less than the depth of the recess, the said radial sealing force offering a greater resitance to rotational movement of the liner member relative to the container than the lug exerts on the ramp element during movement of the cap from the closing to the opening position.

19. A tamper indicating closure for containers, substantially as described with reference to Figures 1 to 4 of the accompanying drawings.

20. A tamper indicating closure for containers, substantially as described with reference to Figures 5 to 7 of the accompanying drawings.

21. A tamper indicating closure for containers, substantially as described with reference to Figures 5 to 7 as modified by Figure 8 of the accompanying drawings.

22. A tamper indicating closure for containers substantially as described with reference to Figures 1 to 7 as modified by Figure 9 of the accompanying drawings.

23. A tamper indicating closure for containers substantially as described with reference to Figure 10 of the accompanying drawings.

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